Evaluation of the effects of Boundary Conditions and Atmospheric Forcing in the SoFLA-HYCOM domain

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UM/RSMAS

In Collaboration with

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Julie Pullen *(NRLMRY)*

Report Documentation Page

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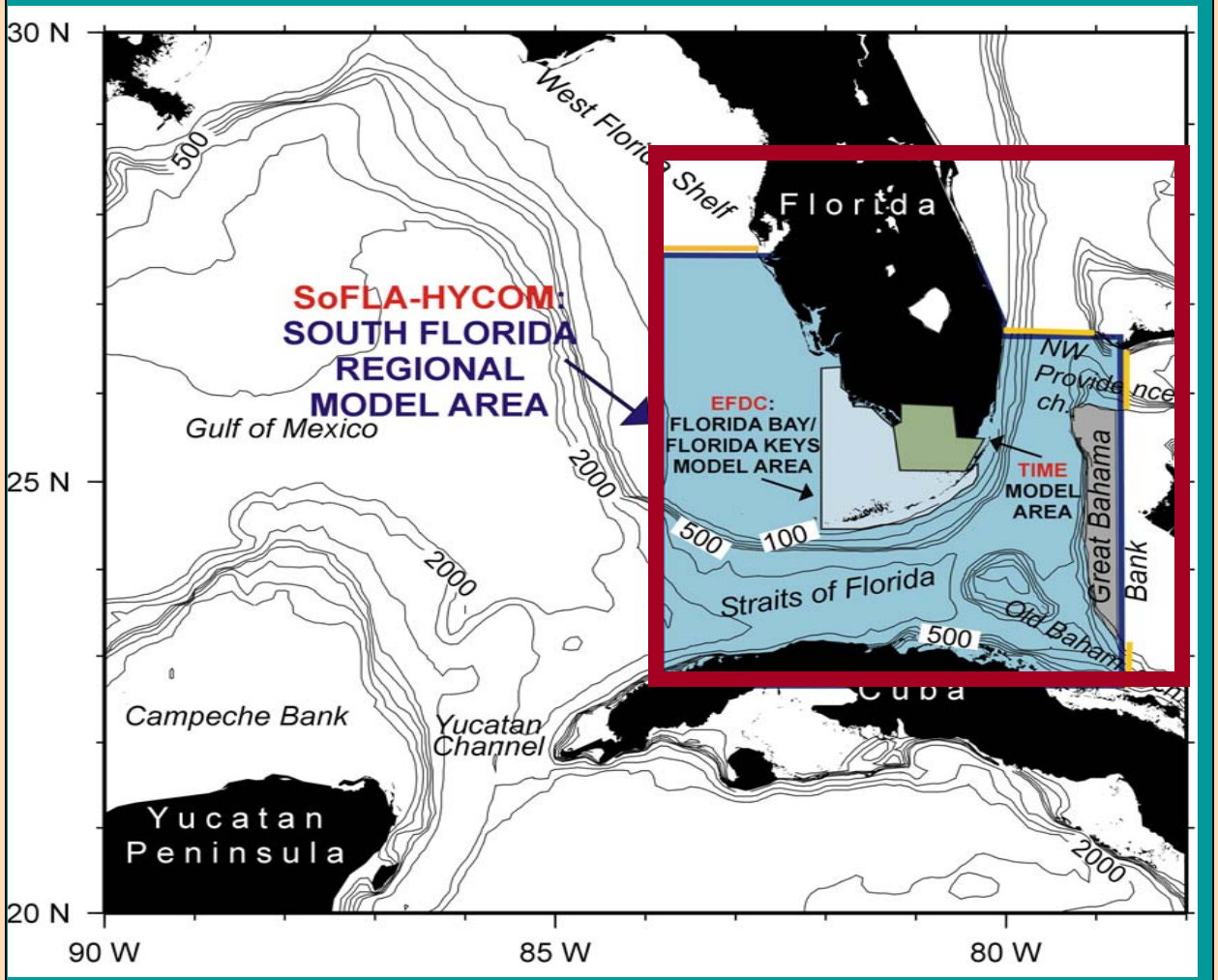
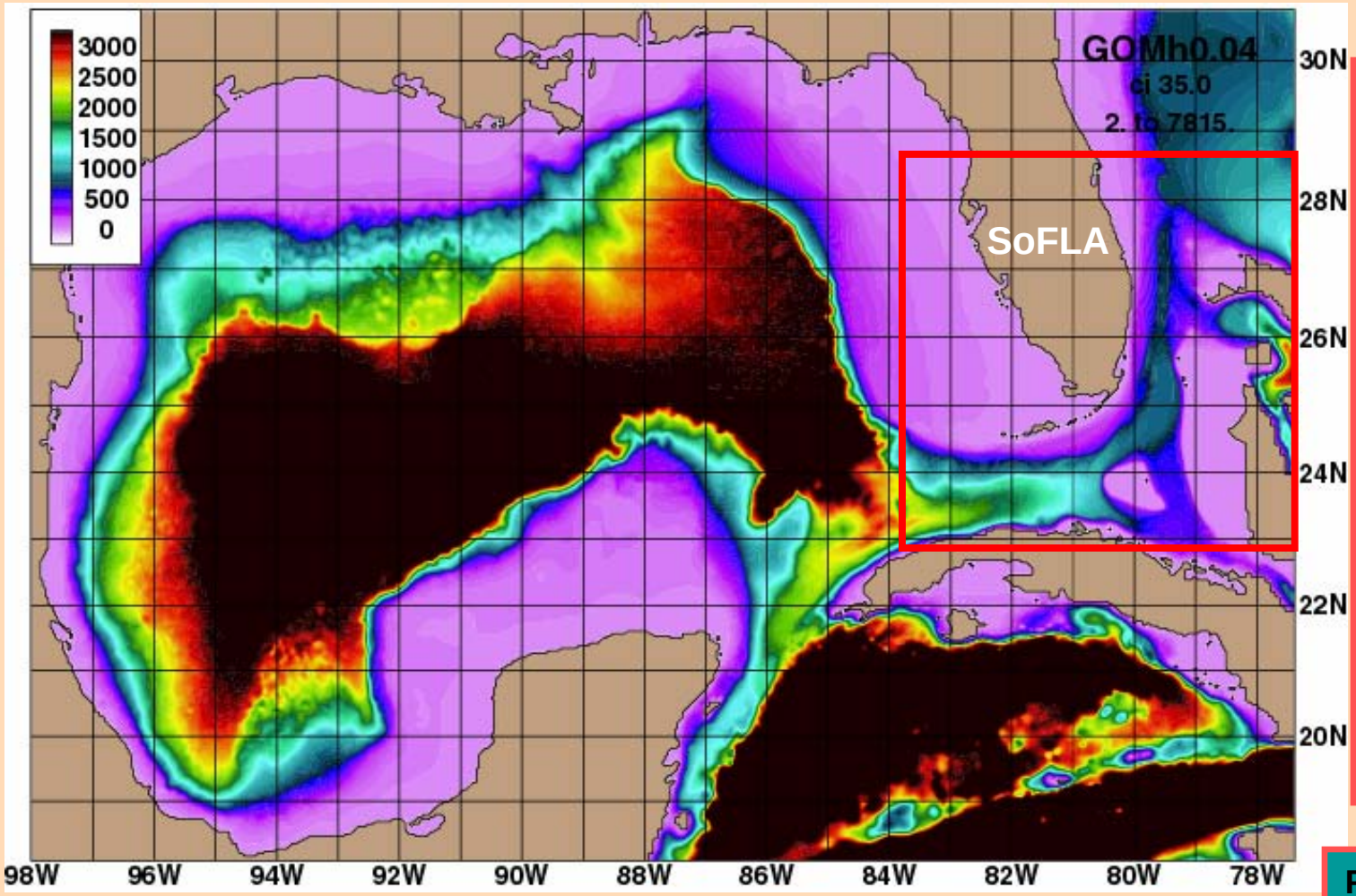
Regional model for South Florida seas: SoFLA-HYCOM

(South Florida Hybrid Coordinate Ocean Model)

- **A multi-nested modeling approach in support of the Comprehensive Everglades Restoration Project (funded by NOAA)**
- **Evaluation of nested simulation strategies in terms of boundary conditions, data assimilation and forcing (funded by ONR-NOPP)**
- **Coupled to a biological Lagrangian model of larval transport to study connectivity and coral reef fish recruitment in the Florida Keys (funded by NSF)**



GOM-HYCOM: GOMh0.04 Bathymetry



FLAh0.04

HYCOM 2.1.35

1/25º resolution:

idm=161

jdm=163

kdm=20

83.76ºW–77.36ºW

22.78ºN–28.61ºN

2 m minimum water depth

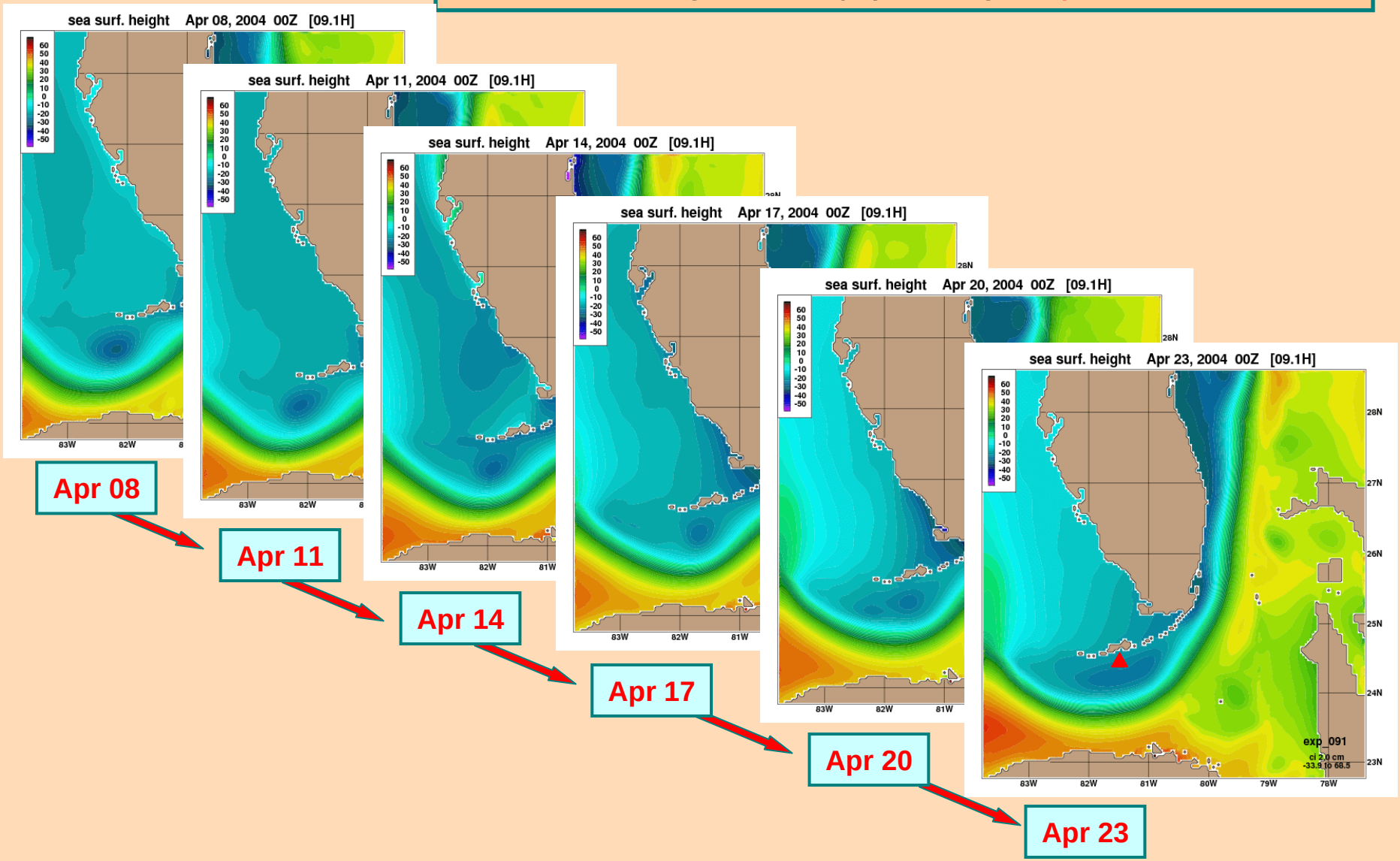
GOMh0.04 1/25º resolution: Idm=517 jdm=349 kdm=20; 98ºW-77.36ºW; 18.90ºN–30.71ºN; 2 m minimum water depth

FLAh0.04 shares the same grid with GOMh0.04 within the SoFLA domain

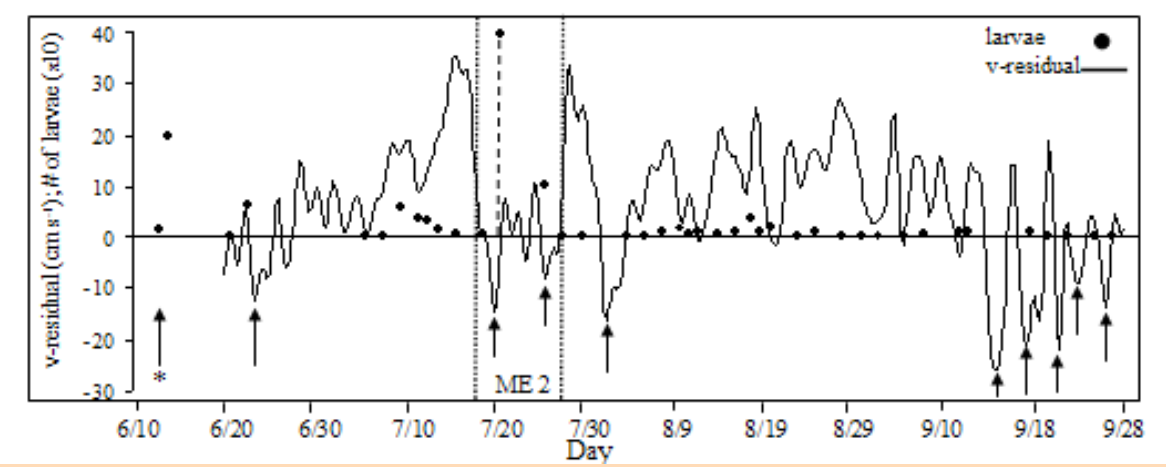
SoFLA-HYCOM: FLAh0.04 Run Numbers and Attributes

RunID	Layers	Rivers	Forcing	Nesting BC	Date
01.1	20	Same as free GOMh0.04	fnmoc-1.0	Free GOMh0.04	2004
06.4	20	Merging 01.1 with FLAe06.4: Rivers_X5	fnmoc-1.0	Free GOMh0.04	2004
09.1	20	Rivers_X9	fnmoc-1.0	Free GOMh0.04	2004, 2005
09.2	20	Rivers_X9X5	fnmoc-1.0	Free GOMh0.04	April and May, 2004
29.1	20	Rivers_X9	fnmoc-1.0	NCODA GOMh0.04	2004, 2005
39.1	20	Rivers_X9	fnmoc-1.0	ATLd0.08	2004
07.1	20	Rivers_X9	coamps 27km	Free GOMh0.04	Jan-Sep, 2004?
27.1	20	Rivers_X9	coamps 27km	NCODA GOMh0.04	2004, 2005
04.1	20	Rivers_X9	Fnmoc-0.50	Free GOMh0.04	2004
02.1	26	Same as free GOMh0.04	Fnmoc-1.0	Free GOMh0.04	Jan, 2004
01.5	26	Rivers_X9	coamps 27km	Free GOMh0.04	2004,2005
02.5	26	Rivers_X9	coamps 27km	NCODA GOMh0.04	2004,2005
03.5	26	Rivers_X9	coamps 27km	ATLd0.08	2004,2005

Simulation of coastal to offshore interactions during an eddy passage April 2004

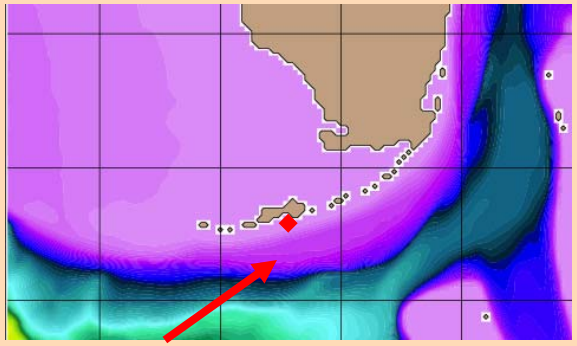


Alongshore current and larval counts during an eddy passage (2001 data)

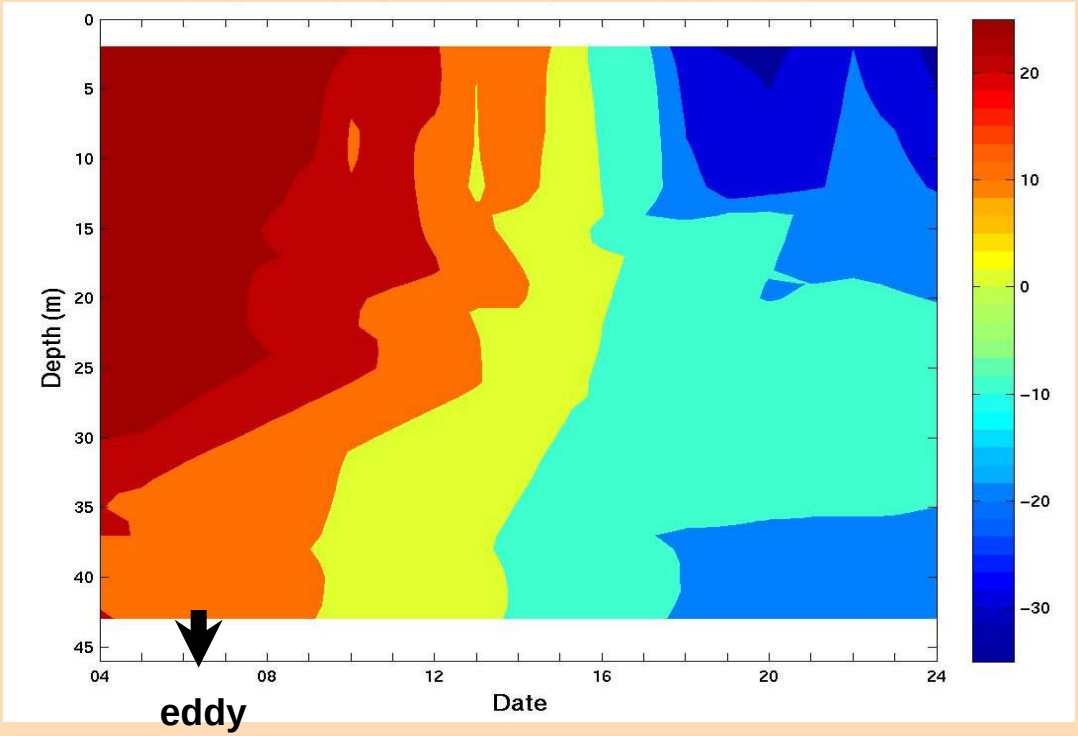


Sponaugle et al., 2005

Along-Shore Current reversal at Looe Key during the eddy passage

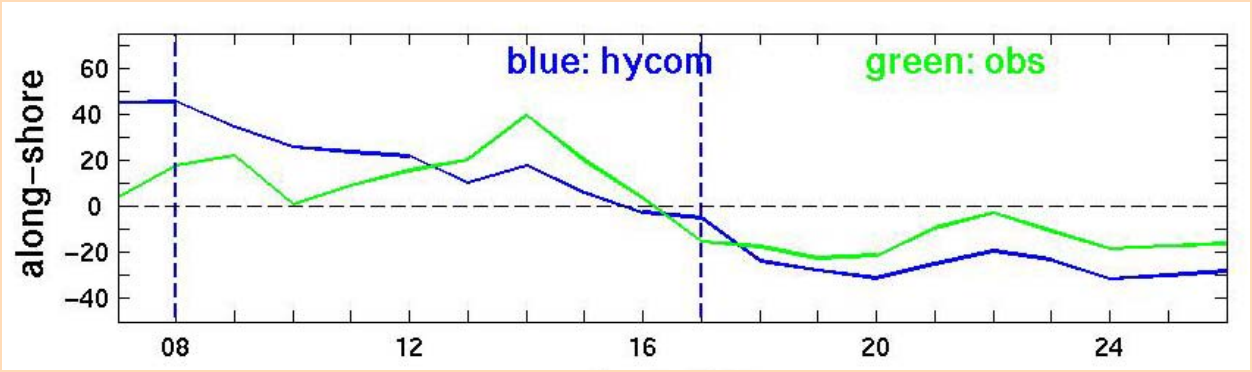


81.4W, 24.65N



eddy enters

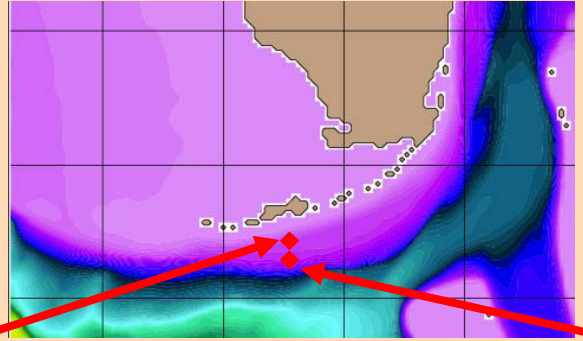
Model to Data comparison



April 2004

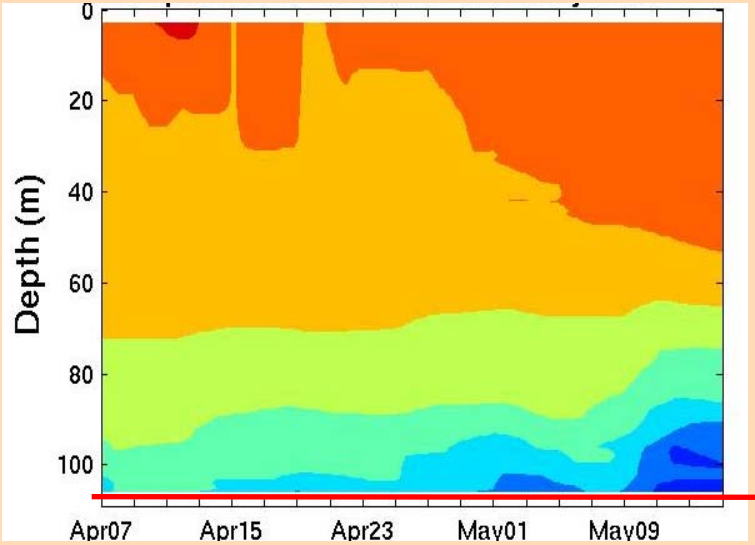
•40 HLP data (rot. 73 deg.) prepared by
Ryan Smith, NOAA/AOML

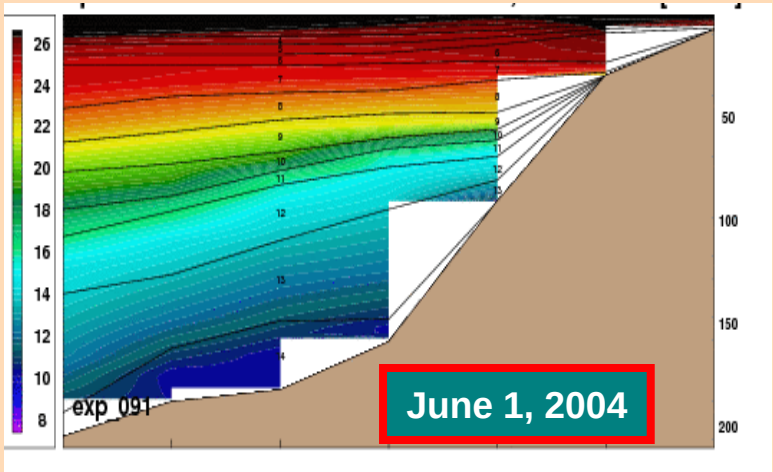
Eddy “signal” at different depths: Temperature cross-sections at Looe Key

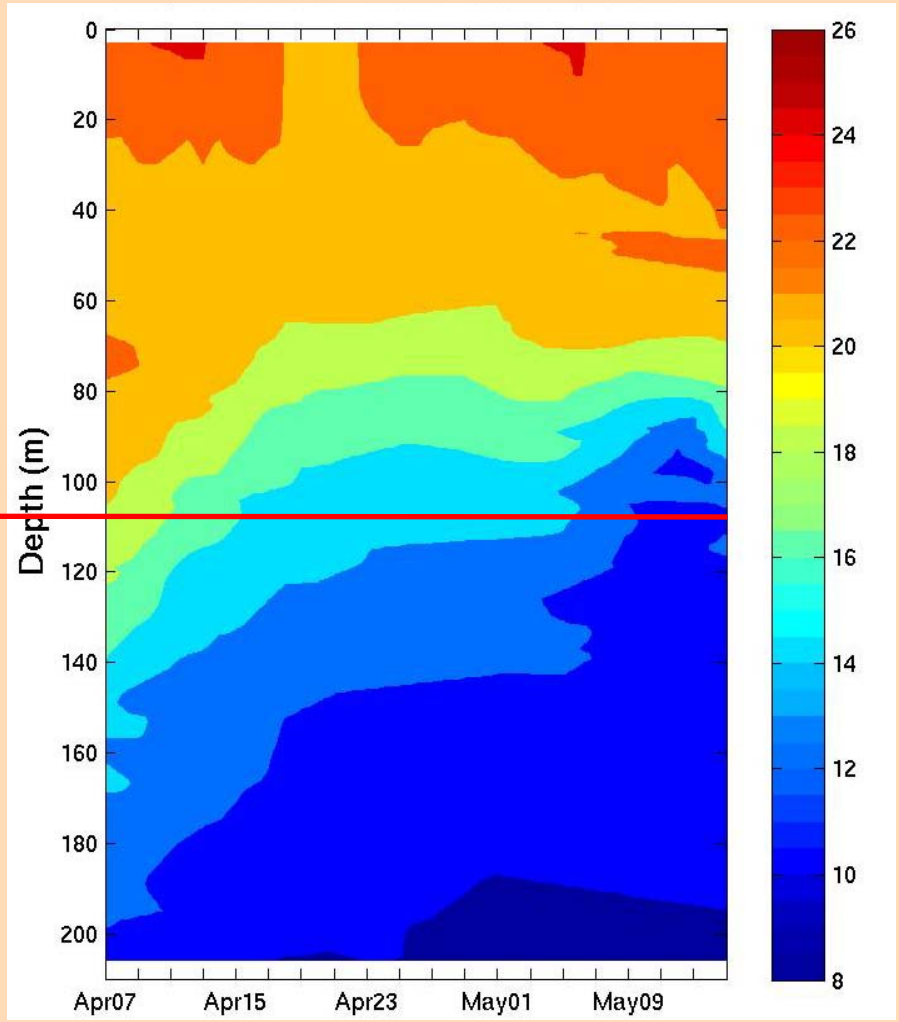


81.4W, 24.5N

81.4W, 24.35N

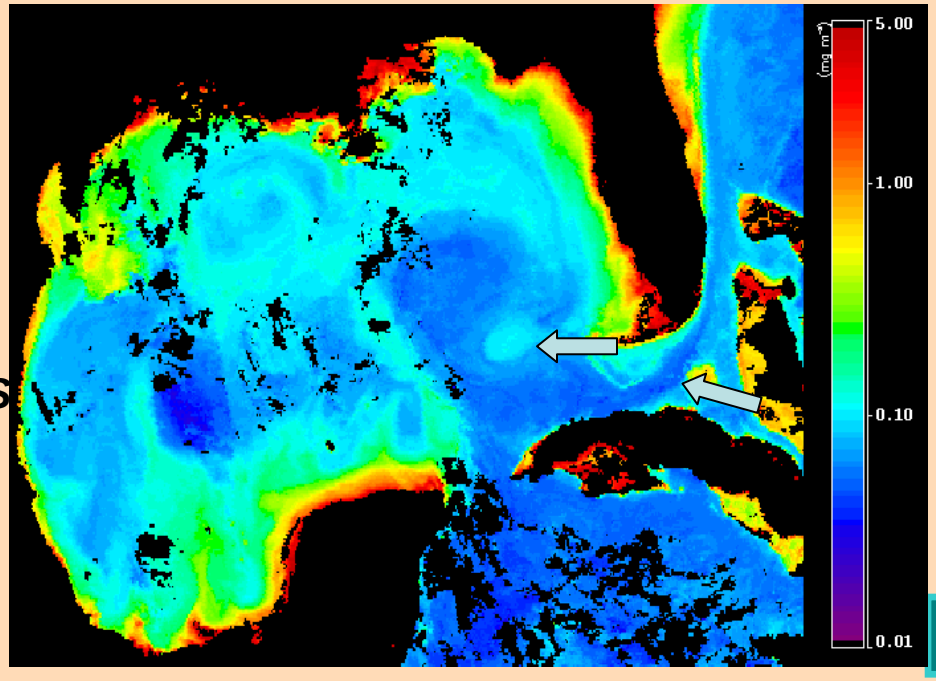






Assimilation effects through Boundary Conditions

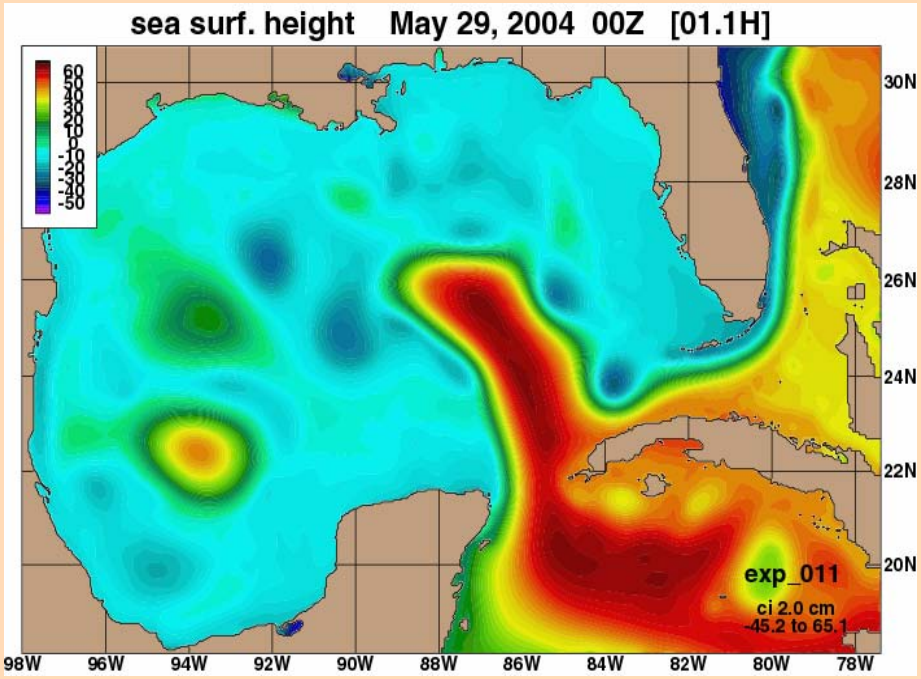
7-days, 5/24-31/2004,
Aqua-chla
Provided by
Viva Banzon, RSMAS
Satellite group

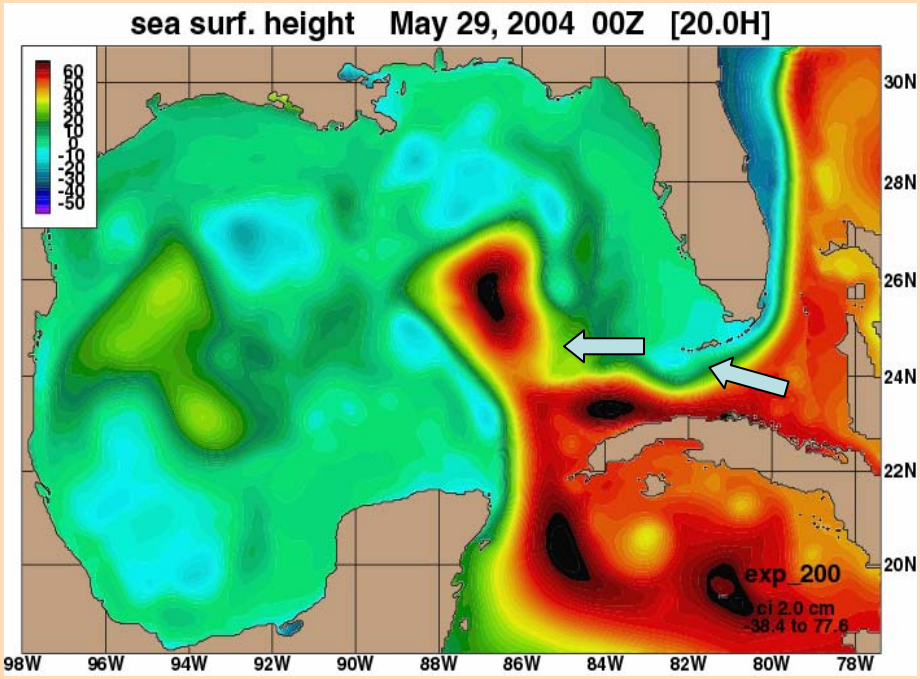


Noticeable improvement on positions of Loop Current and eddies

Free: Pat Hogan

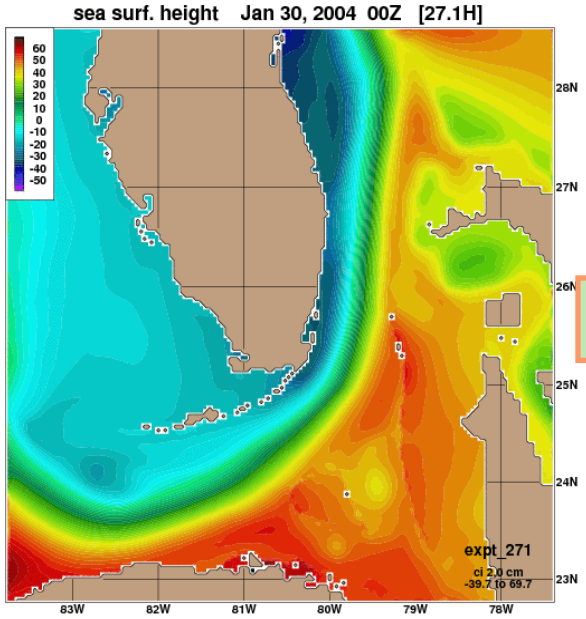
NCODA: O-M. Smedstadt

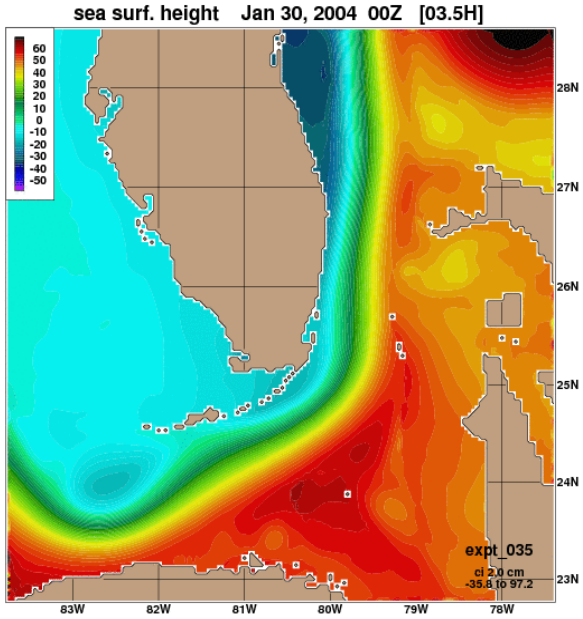




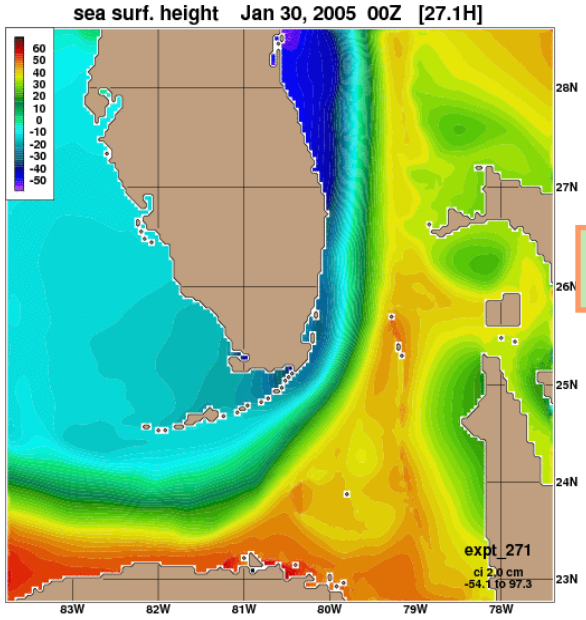
NCODA GOMh0.04 Nesting

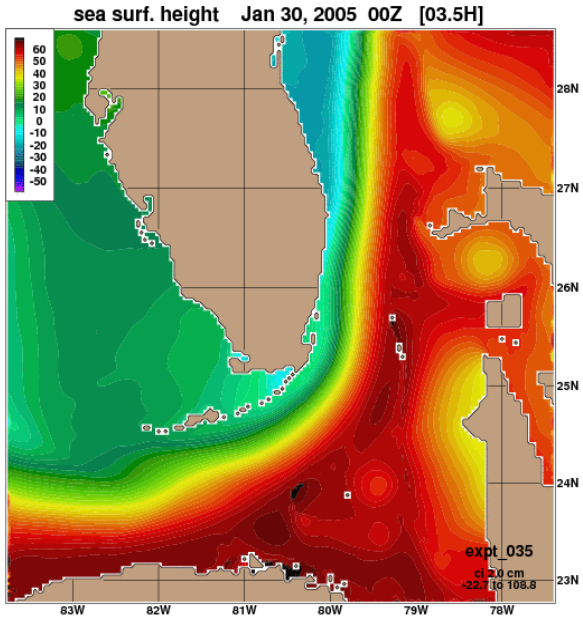
OI NATL0.08 Nesting





Jan 30, 2004



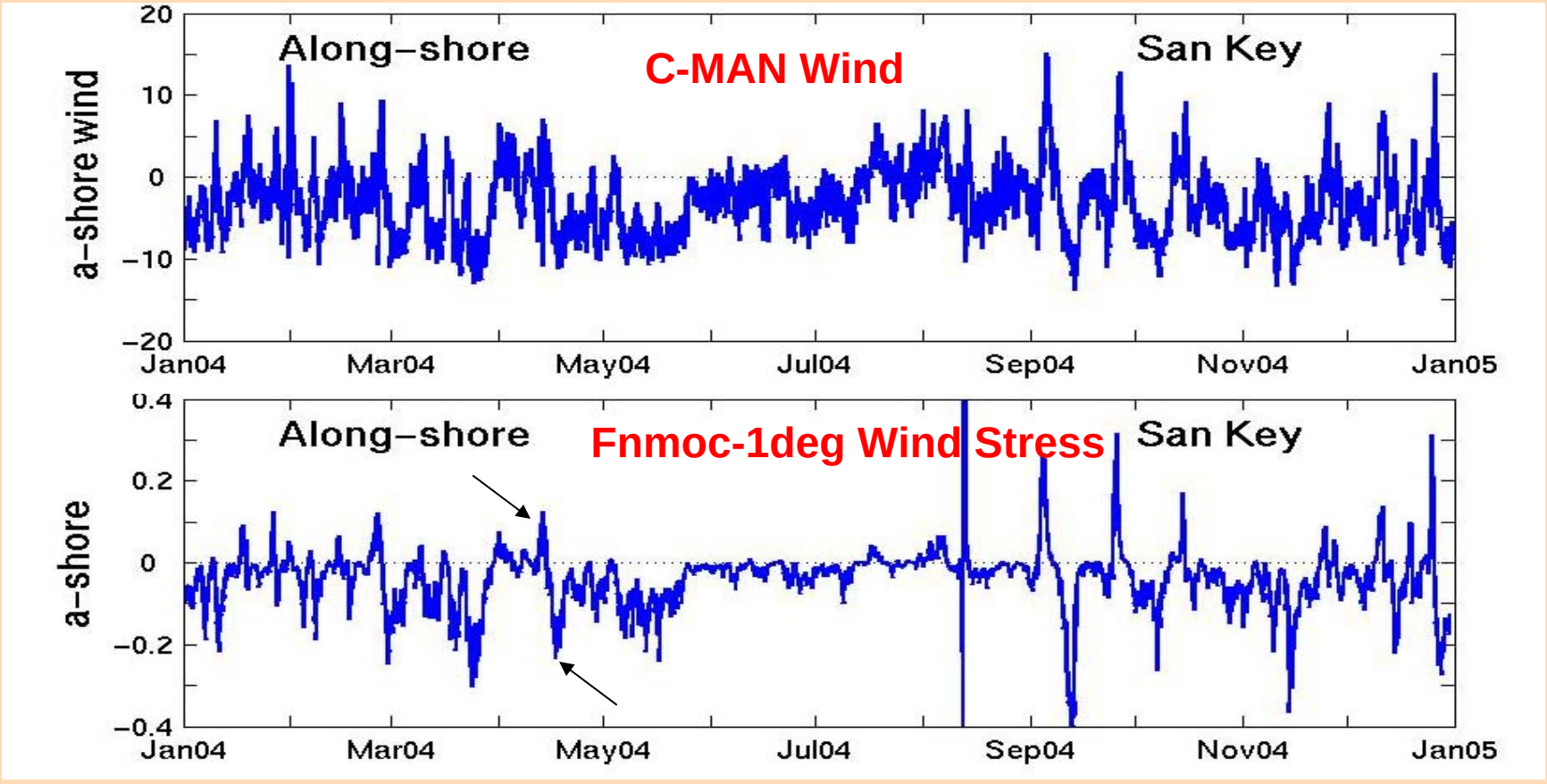


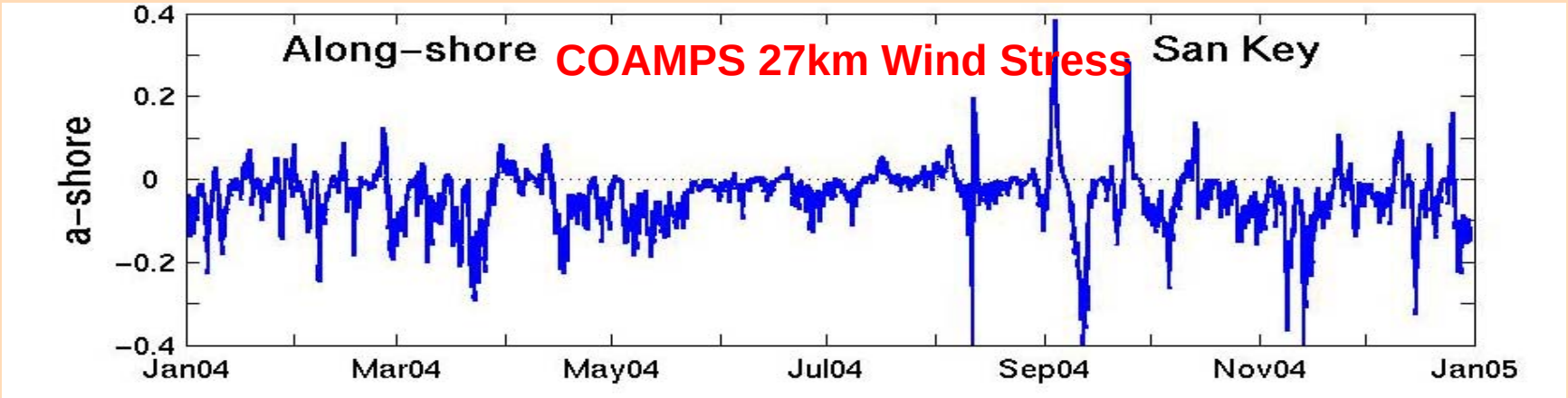
Jan 30, 2005

Impact of Atmospheric Forcing Resolution

(NCODA BC's)

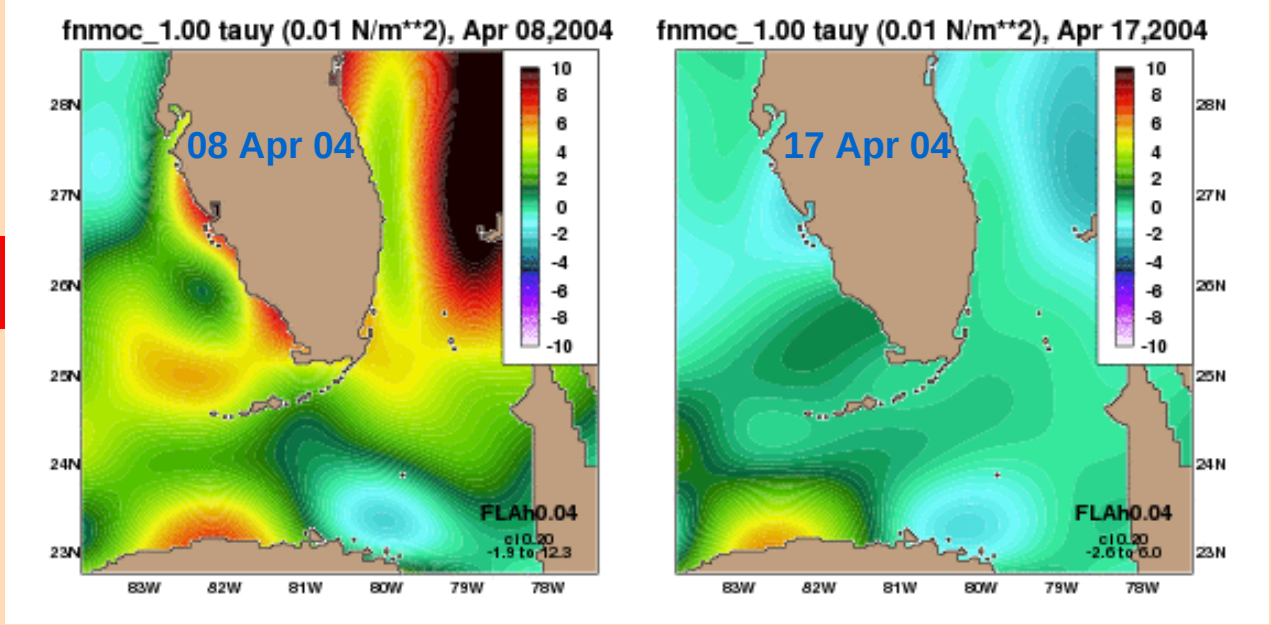
Winds & Stress: Sand Key 81.88W 24.46N 2004 rot=73º



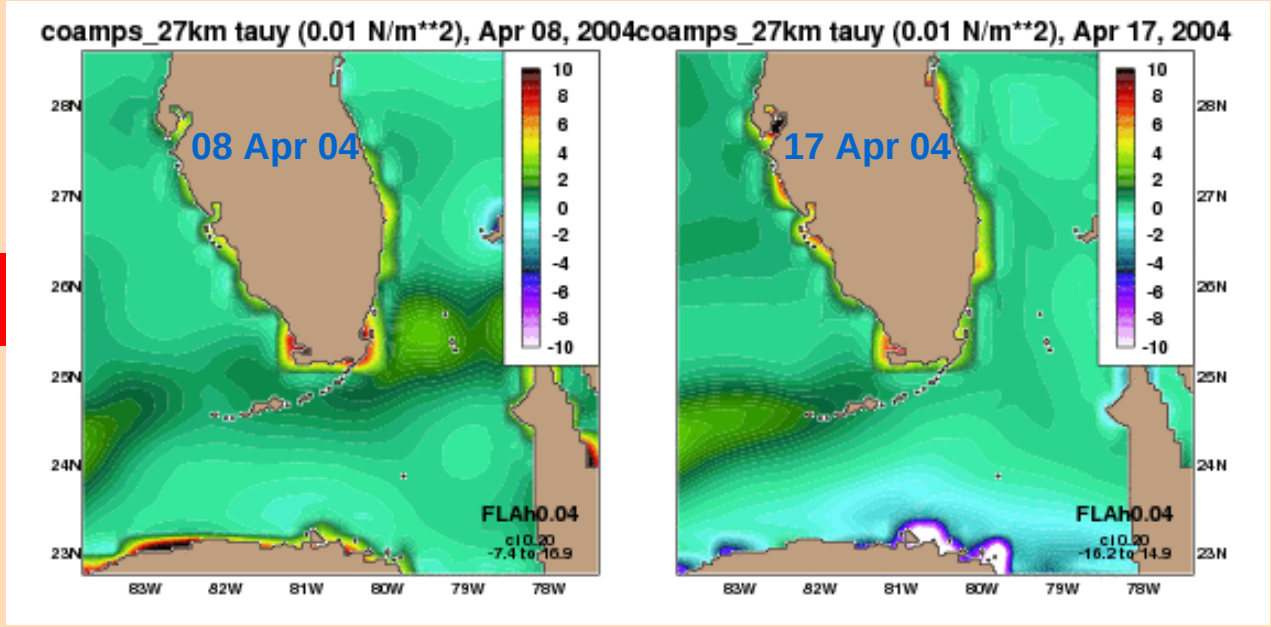


SoFLA-HYCOM: FLAh0.04 Tau-y

fnmoc 1-degree



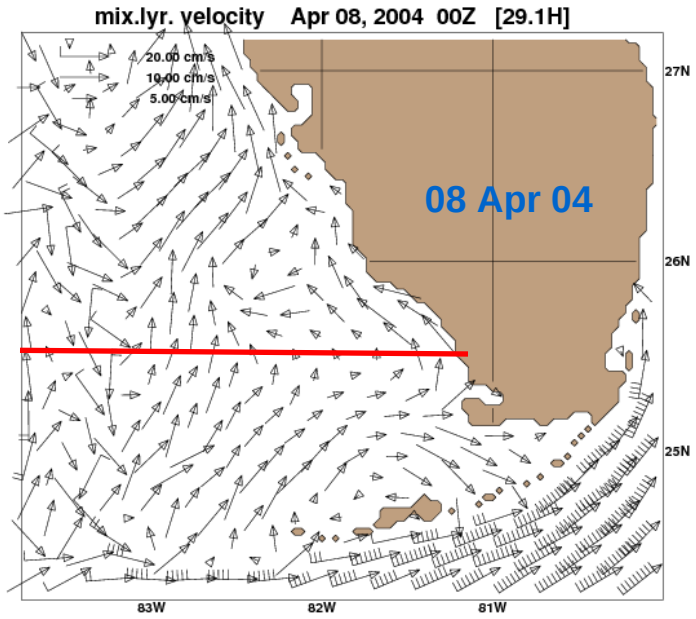
Coamps 27 km

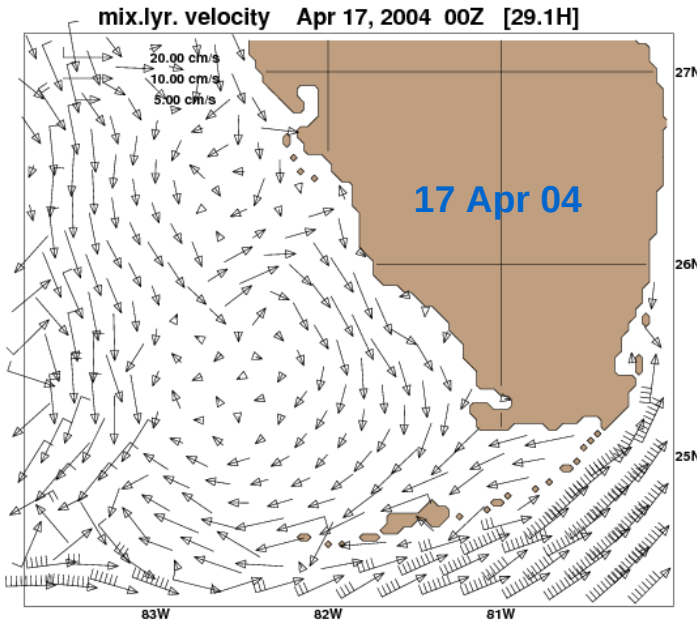


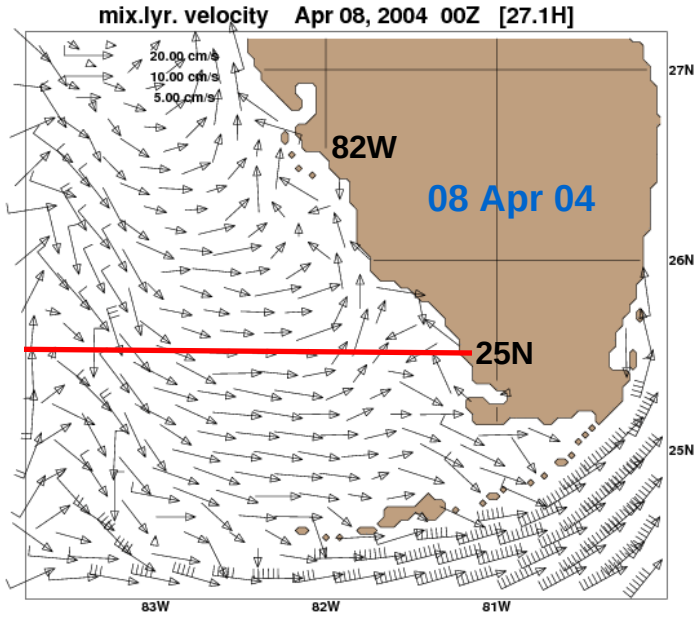
fnmoc 1-degree

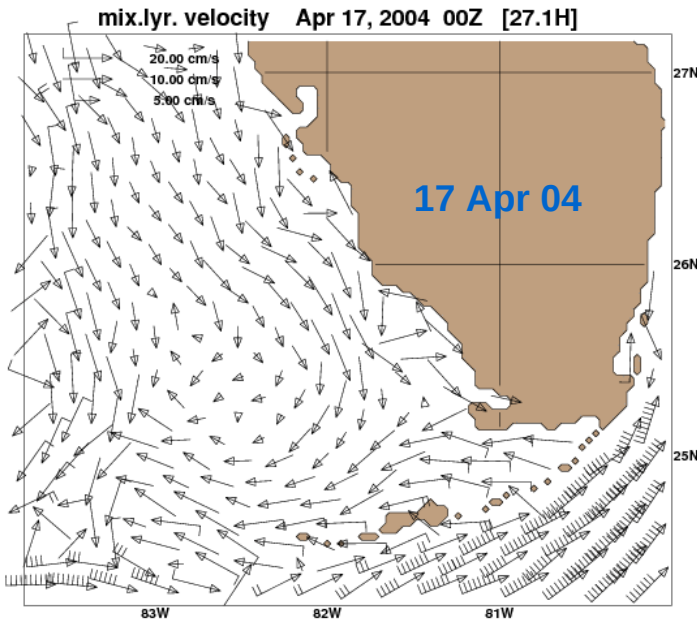
SoFLA-HYCOM:
FLAh0.04 SVEL
West FL Shelf

Coamps 27 km



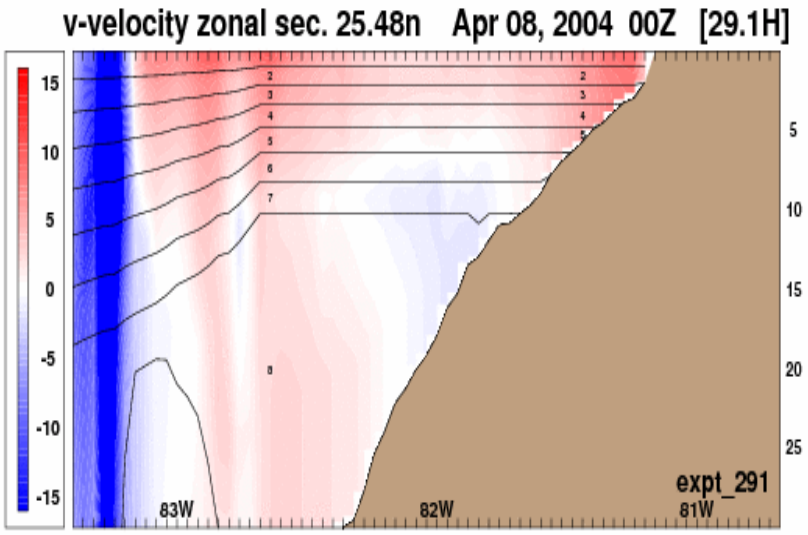


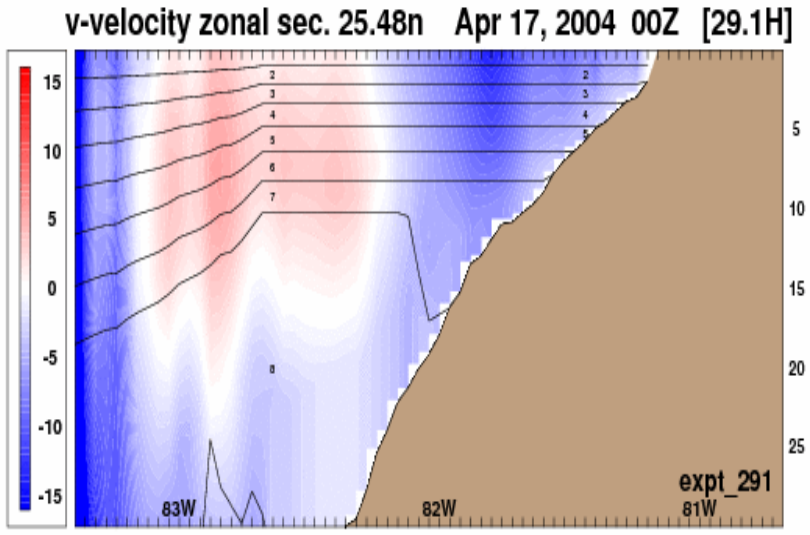




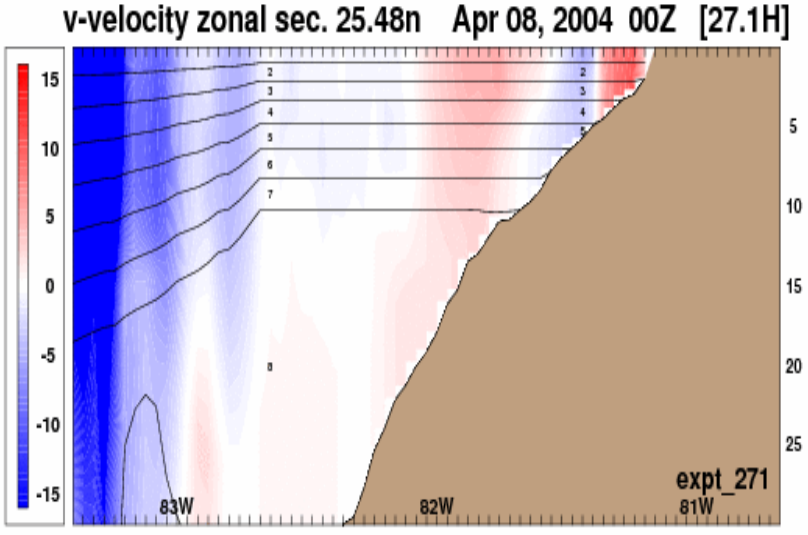
SoFLA-HYCOM: FLAh0.04 25°N v-Comp

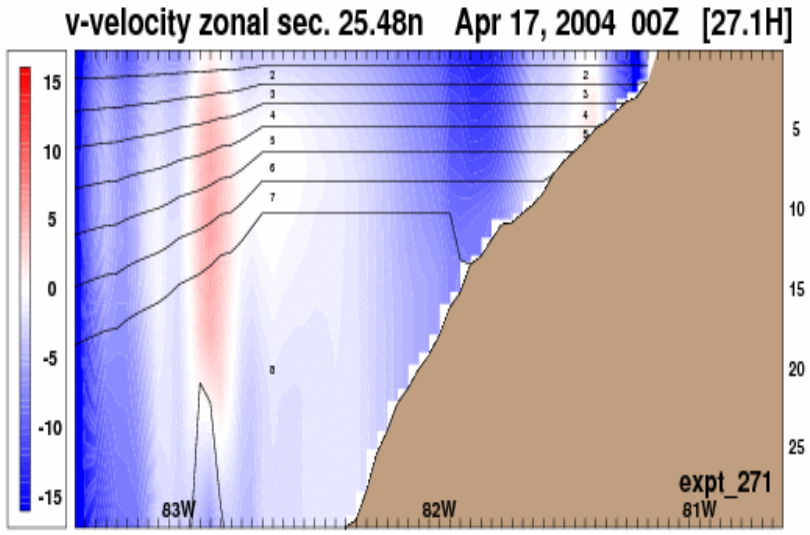
fnmoc 1degree





Coamps 27km

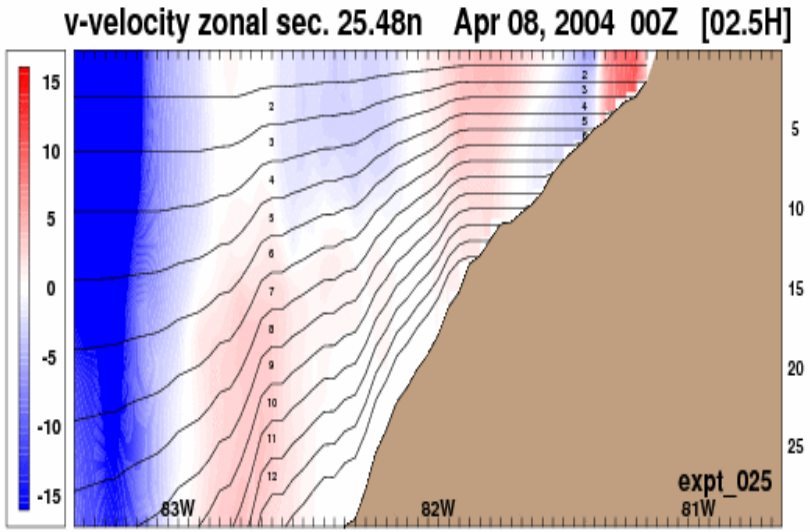


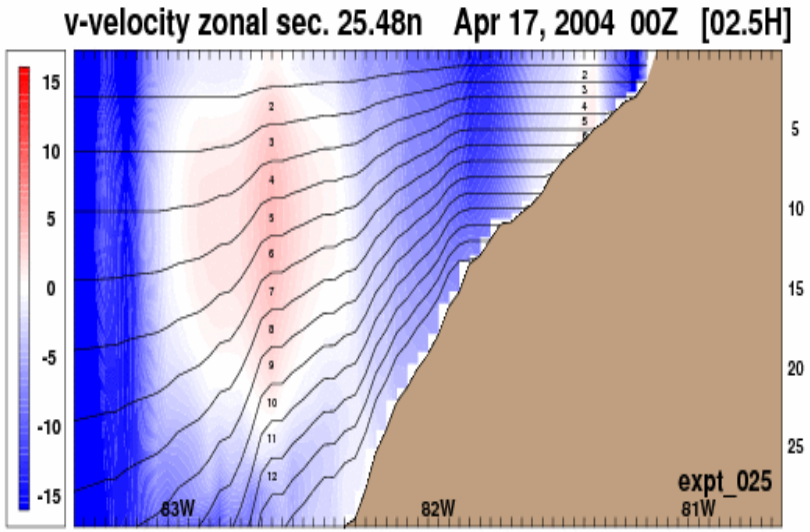


Impact of
Vertical Model Resolution
(coamps 27 km atmospheric forcing)

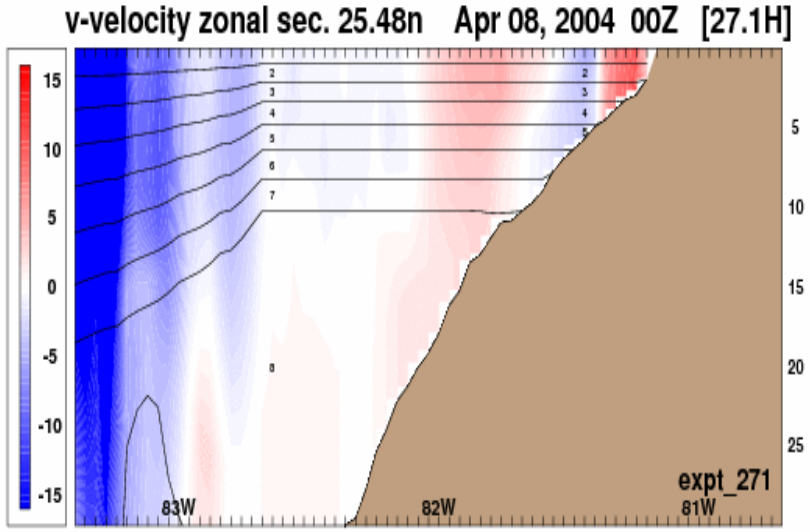
SoFLA-HYCOM: FLAh0.04 25°N v-Comp

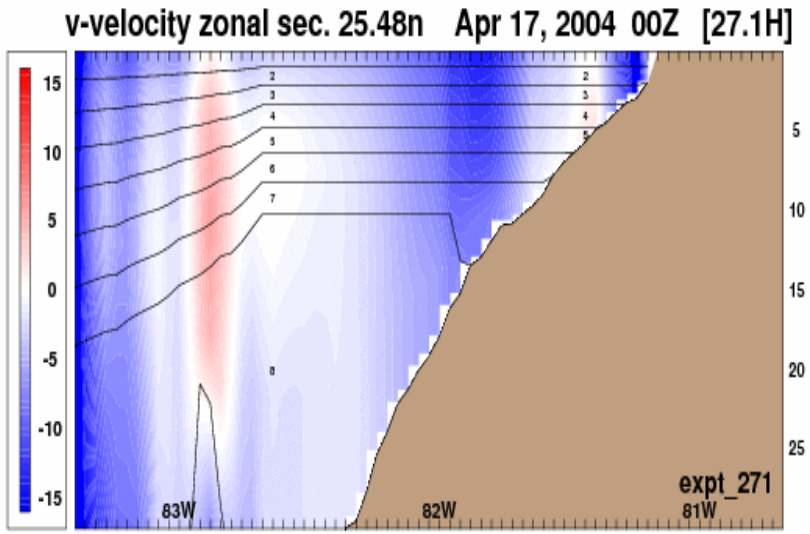
k26





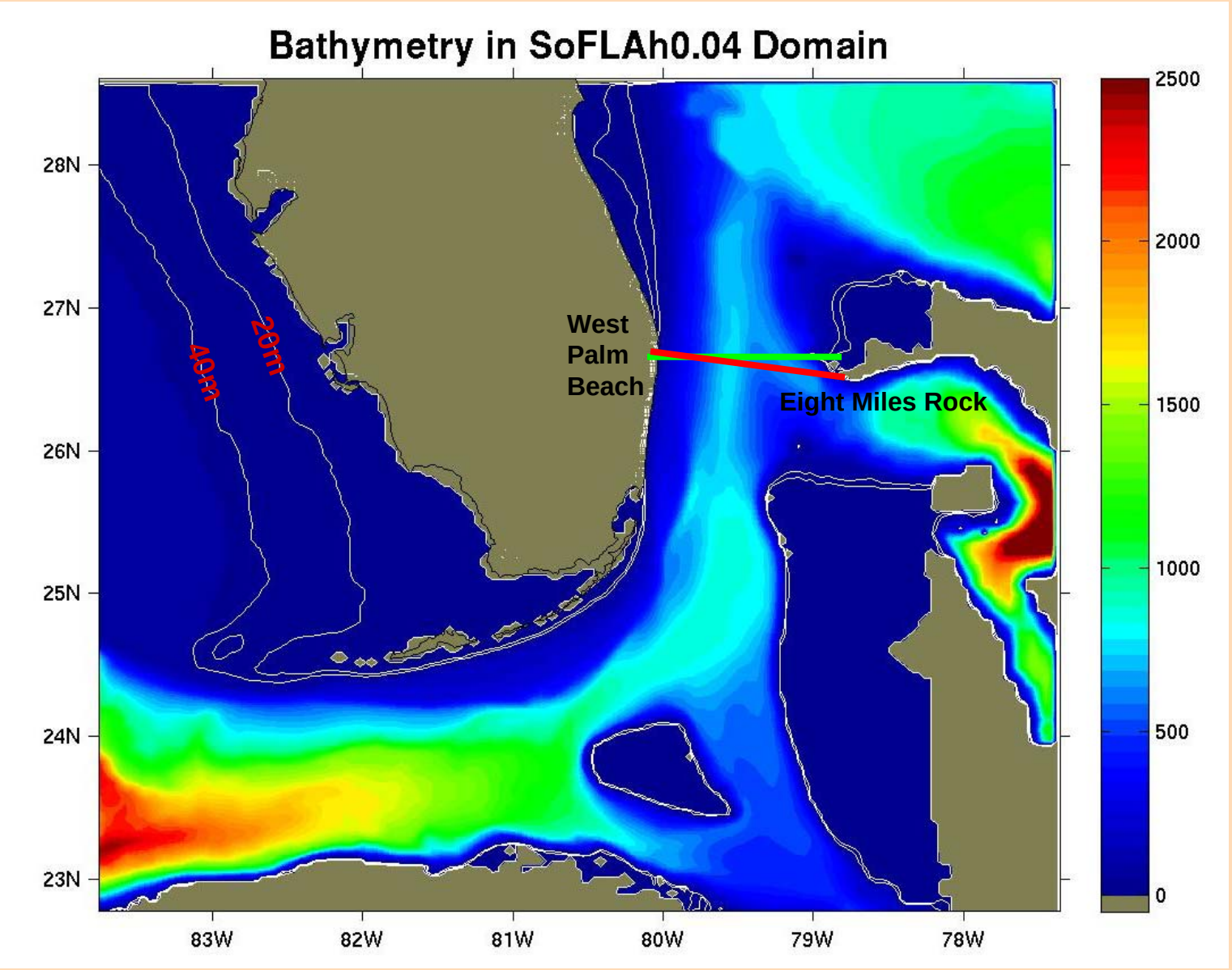
k20





Florida Current Transport

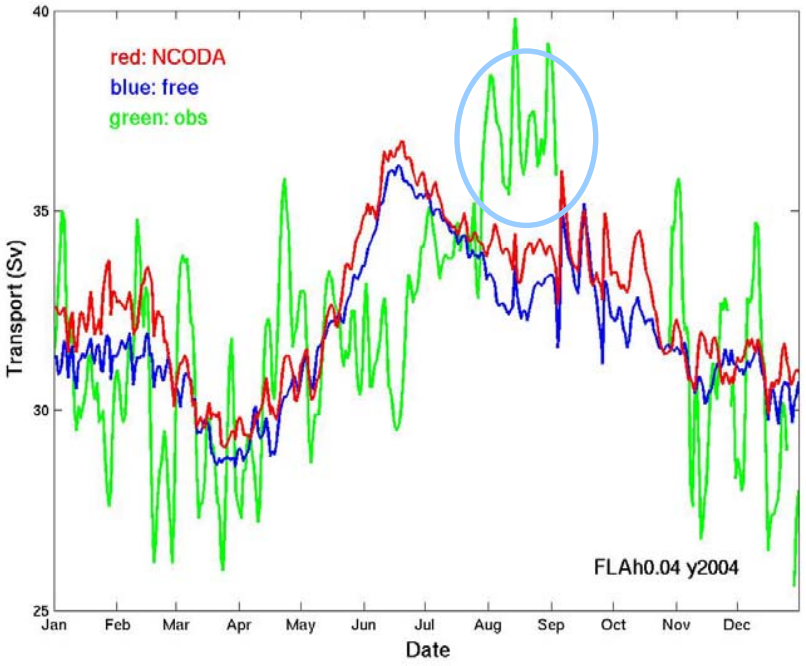
Locations of the Cable and Model Sections

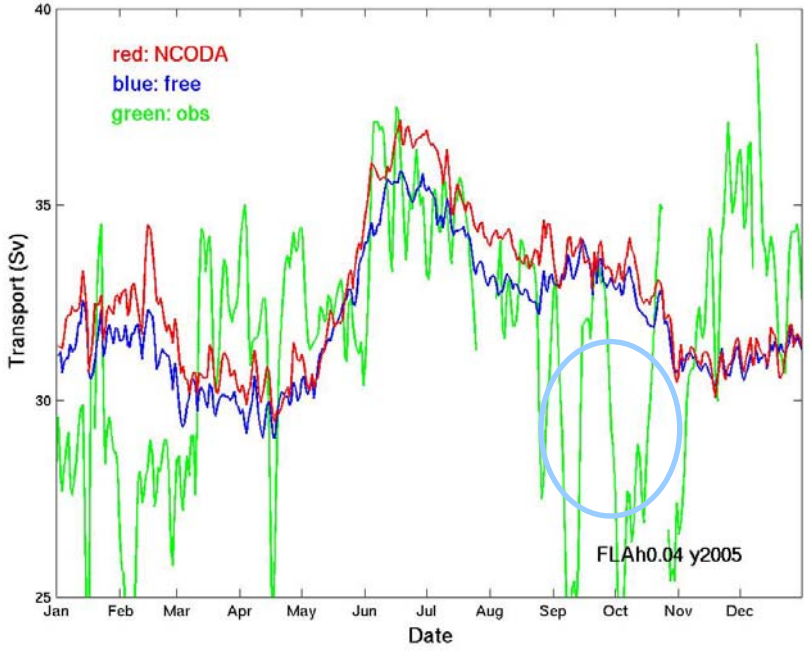


Cable

SoFLAh0.04

SOFLA-HYCOM: FC Transport at 26.7N





Daily Mean 2004

Daily Mean 2005

Statistic Characteristics: SoFLAh0.04

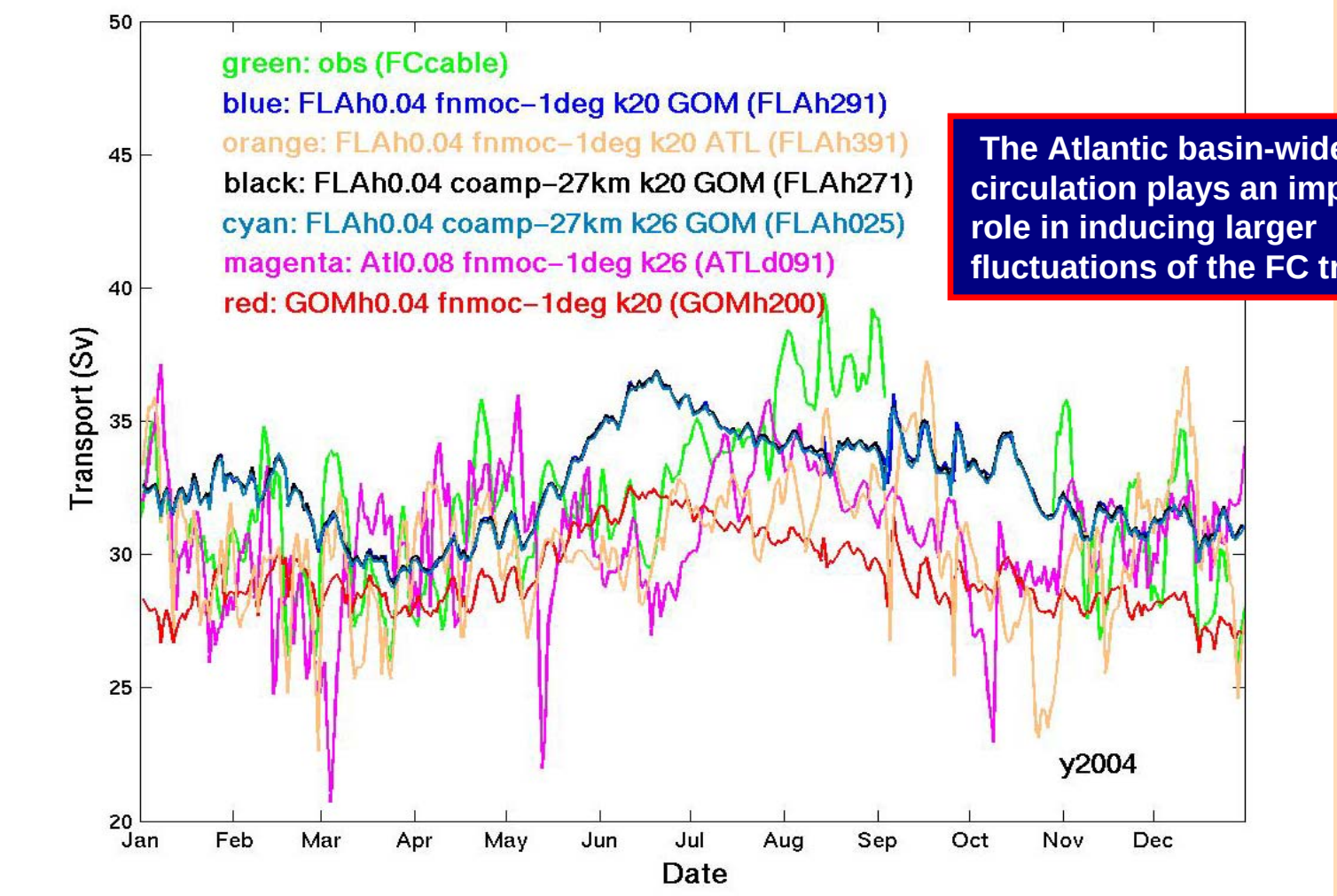
Florida Current Transport: 2004 and 2005

	Free	NCODA	Cable	Free	NCODA	Cable
Mean	31.85	32.46	31.81	32.02	32.62	31.38
STD	1.89	1.96	3.00	1.66	1.88	3.37
	Year 2004			Year 2005		

Missing Cable data:
2004: 9/04-10/28; 12/26-12/28
2005: 7/26-8/03; 10/25-10/26; 12/08

Model data for those days are removed before computing the means and stds.

Cable Data and HYCOM: FC Transport at 26.7N Year 2004

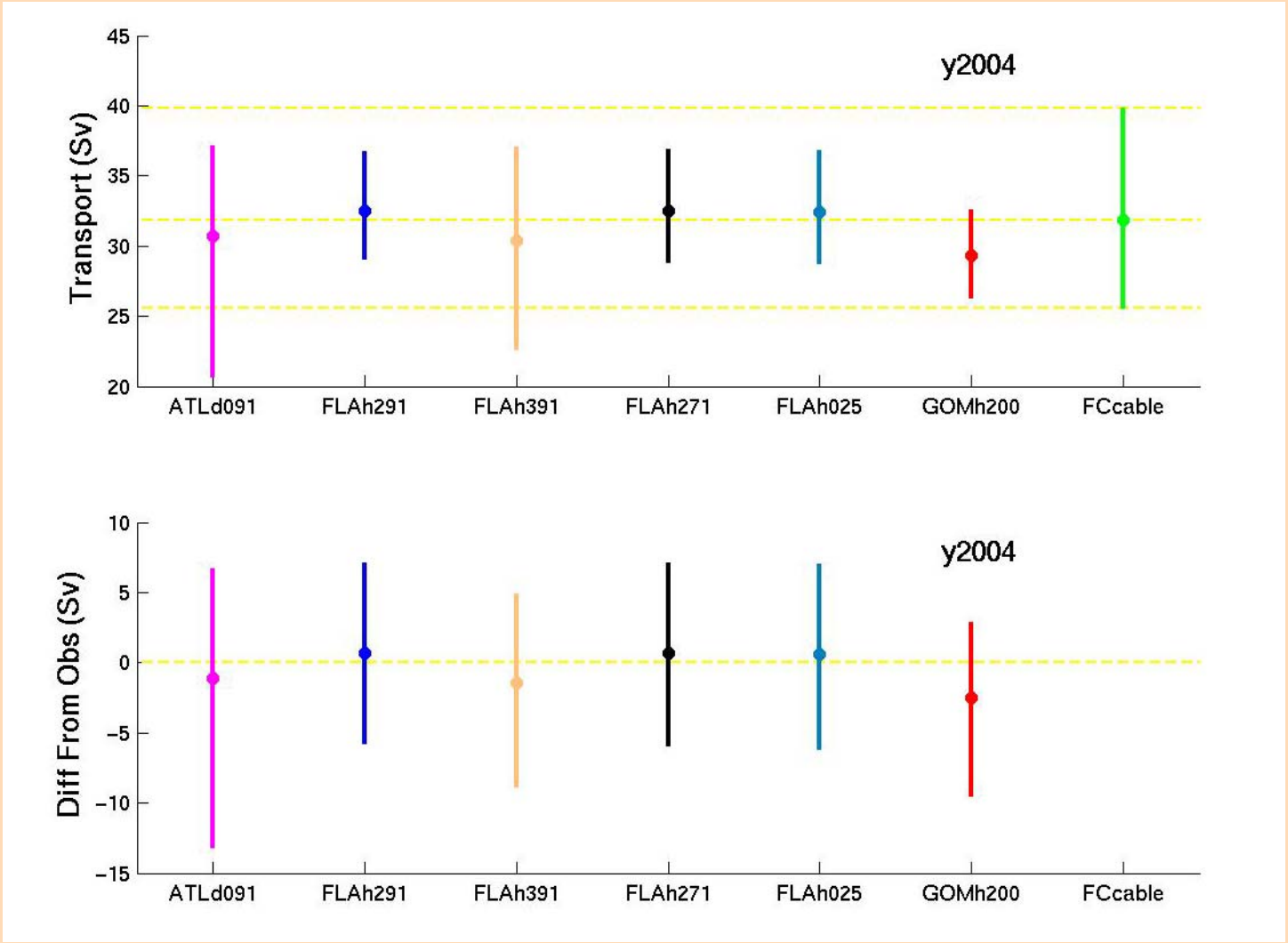


The Atlantic basin-wide circulation plays an important role in inducing larger fluctuations of the FC transport

FC transport at 27°N is not sensitive to the current changes in resolution of the local atmospheric forcing or the adopted increase in vertical layers

FC transport of ATLd091 and archive files of GOMh200 were provided by Ole Martin Smedstad, NRLSSC.

Cable and HYCOM: FC Transport at 26.7N Statistics



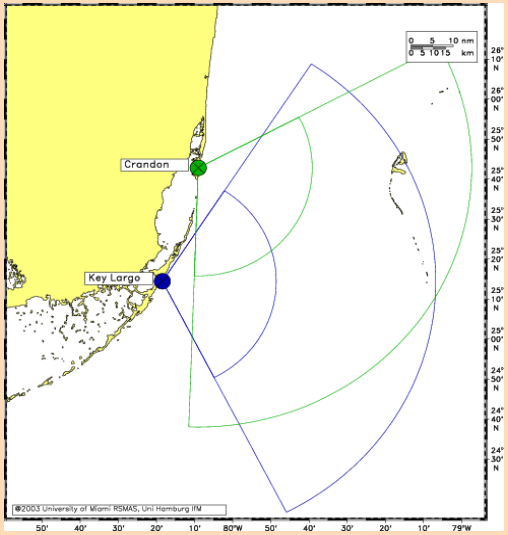
The dots denote the means and the bars denote the range of values: from the minimum to maximum.

Future Work

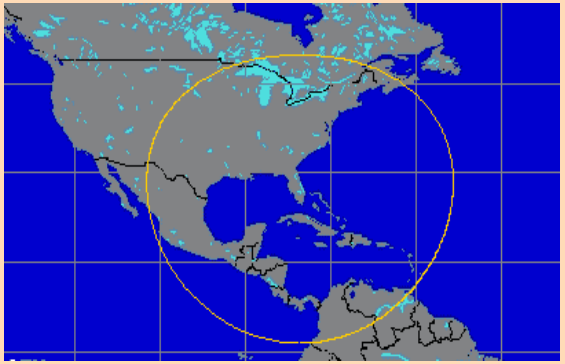
- **Simulation nested in GoM with NAT BC's**
- **Tides**
- **Comparison to in-situ data**
- **Simulations in support of nested FKEYS and coupled BOLTS models**

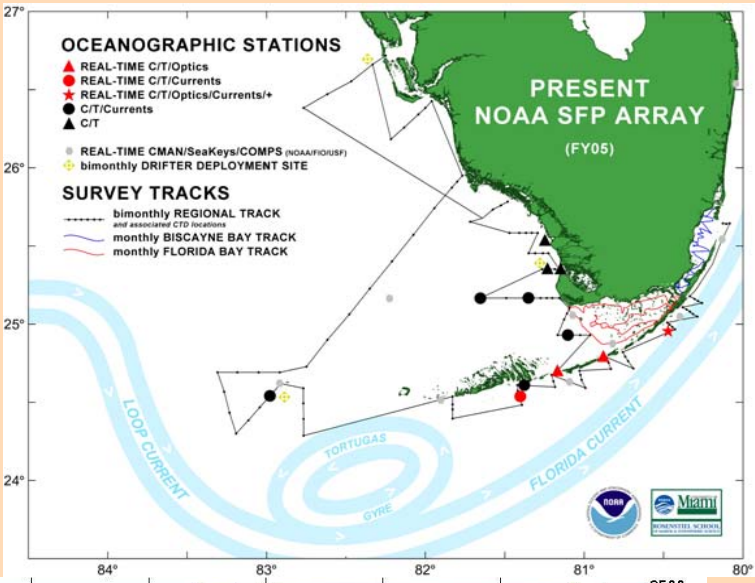
Local Observational Data Coverage in the SoFLA Domain

WERA coverage

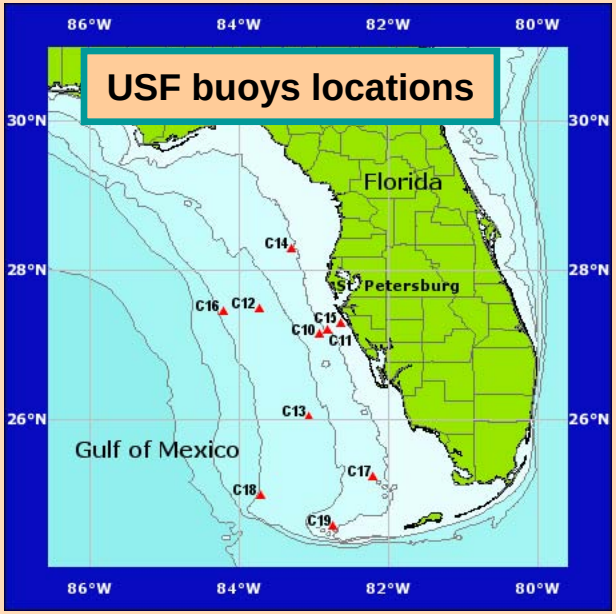


CSTAR coverage





USF buoys locations



▲ : moorings
●: c-man stations
DT: Dry Tortugas
LK: Looe Key
san: Sand Key
smk: Sombrero Key
SR: Sharker River
CR: Caloosahatchee River
▬ : Cable